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Urban Futures in the Era of the E-Economy

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URBAN FUTURES IN THE ERA OF THE E-ECONOMY

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Abstract

The wide use of information and communication technology leads to structural **changes** in our **economy** and society. The impacts of **ICTs** embrace not only a **faster** and denser communication but **also** a reorganisation of **values** 'chains, **firms**, labour relations and management **structures**. In this paper various actual and potential impacts on the **function** of cities are identified and **discussed**. This is based on a **scan** of the literature and empirical research of one particular value chain, i.e. that of financial services. Attention is given to customer driven production, customer services, **desintermediation** and re-intermediation, new **e-firms** and e-webs of **firms**, and flexibility of work **places**. A special focus is on different forms of knowledge and concomitant constraints in electronic communication. The paper concludes with a number of questions and some brief policy recommendations.

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1. Introduction

The use of information- and communication technology in commercial transactions has grown tremendously since the mid 1990s. Most transactions using electronic commerce have been in business-to-business commerce, but business-to-consumer commerce is likely to play an expanding role in the next coming years. **Electronic** commerce has grown quickly as a **result** of the application of e-mail and electronic data interchange (EDI), enabling users to substitute physical papers by electronic forms. **However**, it is the Internet and the World Wide Web that have allowed the stimulation of e-commerce.

An explanation of the popularity of Internet and e-commerce services **can** be found in network extemality theory (e.g. **Katz** and Shapiro 1985; Capello, 1994; Economides, 1996). The positive network **effects** include the **ones** of increasing returns and **first-mover** advantages. Increasing returns **means** that with **each** new subscription to the web, the network increases its user value. Subscription enables actors to carry **out** strategies at a world-wide level. First-mover advantages **means** that **each actor** that **introduces** an innovation on the web **benefits from** publicity and popularity of the name among consumers; this at the expense of followers suffering **from** large marketing **costs**. The growing use of Internet and e-commerce has **also** been approached from a transaction **cost** perspective. From this perspective the following critical transaction and **co-ordination economies** may be observed (e.g. Wigand, 1997): a **faster** and denser transmission of information in communication; a tighter connection in linkages within the **firm**, among **firms** and between **firms** and customers; a bringing together of customers and **sellers** in the electronic marketplace (e.g. electronic auctions); and a **strategic** use of networking in **co-operation** and competition.

The **changes** in society embrace more than just a **faster** and cheaper communication, with increasing intensity of transmission. With the growth of Internet and e-commerce, a new architecture of society is under way. The **changes** - although not **all clear**, because of complex interaction and **contradictory** trends - point to a transformation of the organisation of production (value chains), including the organisation of **firms**, management **structures** and labour relations (Dussart, 2000; Shapiro and **Varian**, 1999; Westland and Clark, 1999), with concomitant spatial impacts. In value chains, for example, old, physical intermediaries disappear **from** particular **places** while new electronic **ones** arise (van Geenhuizen and Nijkamp, 2001; Kenney and Curry, 2001). There has been **quite** some speculation about the

spatial impacts of this transformation, in particular the impacts on cities, ranging **from** the death of cities to the rise of a few global **command centres**.

Against this background, this paper aims to uncover trends and potential developments in electronic communication in terms of connectivity of cities with global grids and in terms of serving the knowledge economy. Particular attention is given to emerging **changes** in the value chain and repercussions on cities as nodes and on related transport flow. The basis for unravelling the impacts of the e-economy on urban functions is a **scan** of the recent literature and an empirical study of a sector subject to strong influence of **ICTs** and e-economy, i.e. financial services (van Geenhuizen and Nijkamp, 2001). The results **can** be seen as what is named “educated guesses”.

The paper is **structured** as follows. First, some **scenarios** on the future of cities are identified and **discussed**. Then there is an analysis of the connectivity of Dutch cities with advanced **ICT infrastructure** in order to **identify** urban differences in potentials for taking advantage from the e-economy. This is followed by a discussion of the **state** of the art in research on electronic communication of different types of knowledge, and an evaluation of the role of **e-**communication in serving the knowledge economy. In the next part the paper turns to a number of emerging adaptations in the value chain with important actual and potential implications for urban functions and transport **flow**, including an assessment of the uncertainty involved.

2. Future Urban Developments

New technological **advances mean** a challenge for our **space-economy**, including the cities. But it is as yet not clear which types of trends **may** be expected. To shed more **light** on the related uncertainties, **many** researchers resort to scenario analysis.

In the literature, one **can** observe two extreme scenario's and one moderate scenario for future urban development in the ICT era - or broader - era of the e-economy. In the **first**, extreme, scenario it is emphasised that modern **ICTs** enable to **overcome** barriers of **space** and **time**. Firms and households become footloose meaning a larger **freedom** in choosing their location. **Homes** as “electronic cottages” are (re)designed to be **access** nodes for households as consumers, workers, etc. In a situation named the “death of distance”, **place** and location no **longer** matter and, as a **consequence**, large cities **weaken** their hold over **economic** and **social**

life (Cairncross, 1997). Urban meeting places, **markets**, entertainment, etc. **will** give way to virtual gathering, e-business, e-information exchange and entertainment (Mitchell, 1995). The **basic** hypothesis here is the ubiquitous access of **firms** and households to **fast** computer networks.

The other extreme scenario says that large cities strengthen their position at the expense of smaller **ones**. This scenario recognises the role of large corporations in decision **making** in the global **economic** system, as **well** as the **fact** that their specialised decision **making** • requiring face-to-face contact • **may** hinder **any** trend for spread. Most probably there are only a few of **such** “global urban **command centres**” in which highly qualified professional skills and tacit knowledge are **produced** and **circulate** (see e.g. Gillespie and Williams, 1988; Graham and Marvin, 1996; Sassen, 1999). **ICTs** help to extend the **dominance** of these cities by enabling **action** at a distance and remote **control** of activities in smaller towns and rural places. In addition, there are various **generic** arguments supporting agglomeration under the influence of **ICTs**. First, the use of **ICTs** has enabled flexible specialisation. This development has stimulated a spatial clustering of supplying **firms** due to the need to build and sustain trust and to transfer tacit knowledge. Secondly, **many economic** activities in cities are strongly interrelated with the here present knowledge workers (e.g. Duranton, 1999). Although distance seems to shrink under the influence of **ICTs**, the local **linkages** of these knowledge workers in the urban labour market are reinforced due to an increasing **demand** for the fast establishment of face-to-face **contacts** in high density knowledge transfer, both with customers and suppliers of services. A third argument in favour of agglomeration is derived from the institutional and social-cultural dimension of cities, which act as a kind of “glue” between **firms** and organisations **making** them perform better. It is plausible that the **social-cultural** dimension of cities acts as a counterbalance against the impersonal and straightforward **nature** of **electronic** communication.

In a third alternative of a more moderate **nature** the possibility of access of various **selected** medium-sized towns and smaller settlements to global **decision-making** networks is **recognised**. In this vision **ICTs** have no deterministic impacts but work through the way in which they are “constructed” in society in complex **processes** of institutional and personal interaction. Socio-economic actions **can** direct the application of the new **technologies** and change their impacts **each time**. The relation between the development of cities and the use of

ICTs therefore, seems complex and non-linear, leading to a variety of results in **places** and **times** (Graham and Marvin, 1996; Malecki and Gorman, 2001; Mitchell, 1999).

The issue of the future of cities is the more interesting because recent research has depicted various important emerging patterns. In Europe there is a general trend for spatial dispersal (e.g. Groth, 2000; Lambooy, 1998). A so-called polycentric model seems emerging, with smaller towns and rural **areas** exhibiting a stronger employment growth than large cities. The relative stagnation of large cities **may** be attributed to certain agglomeration diseconomies here (Manshanden et al., 2000). In addition, in some cases we observe the rise of network cities. In The Netherlands, the northern wing of the Rimcity (including Amsterdam) seems to develop as a network city, not only connected through labour market relations, but **also** through business trips, **shopping** and other leisure trips (van der Laan, 2000). On a lower spatial **scale** there seems an employment increase at the edge of cities, whereas inner city **areas** tend to increase the **function** of living area. These patterns **indicate** the emergence of a growing diversity in density and **function**. The key issue in the context of the e-economy is whether the concomitant **changes** reinforce ongoing trends of spatial dispersal or **weaken** them.

3. Dutch Cities in Grids

This **section** explores the different position of Dutch cities as nodes in (inter)national ICT networks. To this purpose a few **selected fiber-optic** grids are analysed, i.e. **EuroRings** (KPN-Qwest), **Surfnet 4/5**, and **CityRings** (KPN) (Table 1). By considering the **size** of the cities connected with these grids it appears that Amsterdam, as the largest city, has the best connections. Dependent on the type of grid, Rotterdam is **also** in a favourable position. For example, **EuroRings** – grids around European agglomerations – connects both Amsterdam and Rotterdam with other European **centres** and, in the near future, with the largest cities in the US (using the **Qwest** grid) (KPN, 2000). Another example is Deutsche Telekom, that operates an international network in which most recently Amsterdam is included, aside **from** London, Paris and Brussels. Both grids represent international grids established in a **period** in **which** market **demand** determines the location of the connections, i.e. the largest cities.

A different international network is **SURFnet**. It connects universities and research **centres** in various parts of the world and offers the possibility to subscribe for large enterprises. In The Netherlands **all** four large cities are connected, aside **from** eight mostly medium-sized

university towns. To date, **SURFnet4** is being replaced by **SURFnet5**, meaning a capacity increase by hundred, as **well** as access to new generations of Internet. In The Netherlands this network - named **Gigaport** - is heavily subsidised by the government in order to push The Netherlands internationally. By **making** use of Gigaport, knowledge institutes and enterprises **can participate** in advanced research based on new broadband **technologies** that are not available somewhere else, like in research of fast, three dimensional simulation, international tele-consulting and data-mining. The third indicator used here to **identify** the position of cities in **(inter)national** grids, is CityRings (**KPN**), i.e. fiber-optic rings established around relatively large cities to increase transfer and connection capacity. **All** large cities and a **considerable** number of medium-sized towns in The Netherlands are connected in this way (85% of the twenty largest cities).

Table 1 Position of 20 largest urban agglomerations in The Nederland in ICT networks (selected indicators) (1999/2000)

Urban agglomeration according to size	EuroRings (KPN-Qwest)	SURFnet4/5	CityRings (KPN)
Largest city	100%	100%	100%
4 largest cities	50%	100%	100%
10 largest cities	20%	80%	100%
20 largest cities	10%	55%	85%

Bron: van Geenhuizen, 2000.

If we focus in on the international position of Dutch cities based on various **supply-side** and **demand-side** indicators, it appears that only Amsterdam plays an important role. According to a ranking based on the **price** of services, choice of available connections and availability of the most advanced connections, Amsterdam is **fifth** in Europe, following London, Stockholm, Paris and Frankfurt (Graham 1999). According to an indicator concerning the use of Internet, **however**, Amsterdam is third in the world. Of the 50 most **frequently** used Internet routes Amsterdam is end-station of seven routes in the world, against nine **each** for London and New York (Abramson, 2000). As a node in Internet **traffic** Amsterdam **thus holds** a position in the top'of Europe.

Although the **evidence** is **fragmentary**, the conclusion **may** be drawn that there is no death of distance in terms of access to the fastest global grids. Nodes are only created there **where** the

potential market is largest due to sheer **size** of cities or specialised research **functions**. Thus, the urban hierarchy of our world is partly replicated by the current ICT developments.

4. **Electronic Communication in a Knowledge Economy**

Despite high-speed fiber-optic connections, there are a number of constraints in electronic communication. In this context it is common **practice** to distinguish between codified, and tacit knowledge. Contextual communication has been added as a separate **class** more recently (Bolisano and Scarso, 2000; Foray and Lundvall, 1996). **Codified** knowledge is based on **objective facts** understandable for **all** actors that know the language (codes) and consequently, it is transferable between different organisations. In contrast, tacit communication deals with **subjective** knowledge, like personal experience, ideas and **specific** routines. **Much** of this communication is by **chance**, **such** as during **work**, at lunch or **coffee** breaks. A **basic** requirement is that the **persons** involved understand **each** other by using similar conventions and routines in understanding, usually **merely** existing within one and the same organisation. A third form of communication is **often** not distinguished explicitly, i.e. contextual communication, but in view of constraints of electronic communication a distinction seems necessary (Bolisano and Scarso, 2000). Major points of **difference** with the previous forms are the aim of the communication, namely transfer (exchange) of new meanings and new interpretative **frameworks**. Concomitantly, there is a need to avoid predefined methods and outcomes etc., while the communication is basically a long term **process** of **interactive** learning. It seems that innovative segments of the value chain not only **depend** on tacit knowledge between similar organisations but **also** on contextual communication between different organisations, particularly because the **latter** enables “**radical**” innovations, by widening horizons and breaking with existing frames of references.

The **crucial** question is to what extent these three types of communication **can** be **carried out** electronically and lead to **sufficient cost** advantages to be adopted on a large **scale**? Furthermore, is there substitution of face-to-face communication by electronic communication, or is there complementarity of both types? And to what extent is there compensation, like an increase of face-to-face communication on **higher** levels following from electronic communication on lower levels? The answer so far is that there is only substitution of **codified** knowledge and this seems to be accompanied by some compensation. **Tacit** communication and contextual communication suffer **from** major constraints using electronic **devices**, although in the former some progress is being made.

Table 2 Forms of communication

	Codified	Tacit	Contextual
Content	Objective knowledge in facts, figures , formulas, design	Subjective knowledge connected with ideas, perceptions and personal experience	Subjective knowledge about perspectives and interpretative frameworks
Environment	Within and between organisations	Mainly within organisations and between organisations that share culture	Between organisations with a different culture and frame of references.
Way of Transfer	Standard codes	Observation, interactive participation and practice	Continuous real-time interactive learning
Context of Transfer	Intentionally	Intentionally, but often by chance	Intentionally
Success factors	Uniformity of codes	Trust Share of interpretative framework	Different frames of interpretation
Focus	Standardisation, replicability, reliability, speed, efficiency , automatic processing	Flexibility, variability, management of ambiguity	Innovative content, context exploration, richness of form and content
Constraints	Few In EDI a shortage of formalisation of communication	Substantial <ul style="list-style-type: none">Intelligent agents: problems of validity, learning in unexpected situations and trust in delegating tasksMultimedia using interactive tools: impossible to integrate all functions with universal applicability	Structural <ul style="list-style-type: none">Frustration of basic needs: continuous real-time interaction, broad range of information without pre-defined language, variety of means and channelsNo predefined aims and expected results (and costs)

With **regard** to codified knowledge there are no constraints as long as **the** communication is sufficiently formalised. Thus, an increase of the use of **Electronic** Data Interchange (EDI) is only hampered by a shortage of universal languages in business communication. For **tacit** communication, there are **much** more constraints. Trust and similarity in interpretative framework are critical **success** factors, and these **can** only be established in face-to-face communication. From experiences with global **virtual** teams in geographically distributed decision-making, one **may draw** the conclusion that important **decision-making** can be done using **electronic devices**, but there remains a need for face-to-face communication **from time to time** to **refresh** relationships **and** to re-establish trust and confidence (e.g. **Maznevski** and

Chudoba, 2000; Mitchell, 1999). Furthermore, two approaches to deal with the **specificity** of **tacit** knowledge transfer, i.e. the use of intelligent agents (based on **artificial intelligence**) and multimedia with interactive tools, have led to important progress but still suffer from serious shortcomings (Table 2). For example, the use of intelligent agents suffers **from a lack** of validity in the representation of **mental** models by **codified** software and a **lack** of trust by the user. In addition, multimedia approaches are only partly able to match with the need for the richest information content and for a **whole** array of possible **functions** with universal applicability. With **regard** to contextual communication, one **may** say that substitution of **face-to-face** contact seems impossible, **also** on the **longer** term. The major reason for this is that some important points of departure are not defined in **advance**, i.e. the aim of communication and the **means (channels)**. In addition, the communication is a long-term interactive **process** using a great variety of **means** and content.

At the same **time**, in daily personal and professional life there is a continuous evaluation and selection of communication modes (Table 3). By using two dimensions, i.e. the **time** dimension in terms of synchronous and asynchronous, and the spatial dimension in terms of local and distributed, we **can identify** four different modes. It seems that **all** modes have their appropriate **roles**, and choices **will** be made dependent on **needs** for **specific** communication and willingness to **pay** the associated **costs** in particular **contexts** (Mitchell, 1999). For example, e-commerce is mainly in the quadrant distributed, synchronous. This is **also** true for global virtual teams **active** in distributed **decision-making** but, as indicated previously, a key **success** factor is additional local, synchronous communication (face-to-face contact) on a regular basis.

Table 3 Advantages and disadvantages of modes of communication

	Synchronous	Asynchronous
Local	Requires transport Requires co-ordination Richness of communication (intense, personal) Very high costs	Requires transport Eliminates co-ordination Reduces costs
Distributed	Eliminates transport Requires co-ordination Requires additional modes in complex communication Reduces costs	Eliminates transport Eliminates co-ordination Limited to particular communication Very low costs

Source: Adapted from Mitchell, 1999 (p. 138).

In general there has been a move towards the **very** low **cost**, distributed asynchronous quadrant in the past decades. As we have seen previously, there are **quite** some constraints in the distributed, synchronous quadrant for **tacit** and contextual communication.

5. Urban Functions in the Future

In this **section** we focus in on a number of adjustments in the value chain, partly based on empirical results **from** the financial sector. It is important to note that the financial services chain, like for example travel agency services, deal with immaterial services. The situation is more complex for chains including physical goods, because these have to be shipped to the customer. The following developments **can** be observed:

- an increased customer driven production
- an increased **importance** of customer services (customer management)
- a removal of sections of chains (desintermediation) and an entering of new intermediaries (re-intermediation)
- the rise of new **e-firms** and webs with **e-firms**
- increased innovation
- an increased flexibility of work locations.

Customer-driven Production

The phenomenon of increased customer-driven production need to be seen in the context of mass-individualisation. E-commerce matches this development because there are lots of opportunities for selection and price-reduction, for example using “**co-buying**”. Consumers **may scan** offerings world-wide, using search machines to **compare prices** and using intelligent agents to negotiate. Accordingly, consumers **may** select unique packages of **products** and services. This **holds** true for financial services, books, **music**, travel reservation, **consumer electronics**, toys, apparel and self-assembly personal computers (ABN-AMRO, 1999). A major **consequence** is the closing down of retail outlets or service **offices** at the lowest level. In financial services, known for the use of a wide range of **electronic devices** in routine transactions, we have seen a closing down of local **offices** by 21% in the past seven years (Table 4). This implication is **also** true for travel agencies, book shops, **music** shops, and employment agencies. **However**, it must be noted that the contraction at the lowest level of

services **can** partly **also** be ascribed to **processes** of rationalisation following mergers and acquisition.

A true customer-driven system **means** that risk and inventory **can** be removed **from** the system, leading to particular **cost** reductions. The **changes** in logistic organisation and transport are not known to date but what stands **clear** is an increase in the number of trips and of the distances involved, as **well** as changing **roles** of distribution **centres**. A major point of attention is to improve customer delivery.

Customer Services

The **second** development – an increased supply of customer services – is **also** evident in a number of chains. These services are based on personal face-to-face contact and physical presence of consumers. Pre-sales for example, deals with customer **specific advice** and user information. For particular goods, it is necessary that consumers **touch, feel** and test the product, or **merely enjoy** the atmosphere (the so-called “shopping experience”). It is plausible that **such** services **can** only be provided at **higher** levels than the **local**. In the United States **electronic** banks make 65 to 70% less **costs** than existing “**brick and mortar**” banks, meaning that they **can** supply services at cheaper **rates**. Accordingly, “**brick and mortar**” banks **feel** the need to preserve the loyalty of their clients and supply custom-made services based on a deep knowledge of the clients’ **profile**. Thus, the financial sector shows the rise of meeting **places** between **banker** and **client** at the regional level. The rise of regional bank **offices** with extended personal services **can** be seen as a kind of “compensation” for the **loss** of **face-to-face** contact at the lowest level.

Desintermediation and Re-intermediation

Desintermediation **often** occurs at the end of the value chain, but in some chains a **whole** range of intermediaries **may** disappear. This is the case if **music** players or writers (poets) sent their work directly to customers, thereby circumventing producers, wholesale and retail. In other chains one **may** observe the disappearance of physical intermediaries like auctions and **purchasing** agents, as **well** as the joining of virtual intermediaries. Internet **business-to-business** auctions are meant to purchase globally at cheapest **rates**. Some **firms** have established vertically oriented sites, like General Motors and Ford for **car components** and Boeing for **aircraft components**. The disappearance of physical segments of the **value** chain

may cause a decrease of **importance** of cities as meeting places, trade- and transaction centres, and **may** concomitantly lead to a reduction of the traffic concerned.

In **financial** services and **many** other chains one observes the emergence of virtual intermediaries that support consumers in information gathering and processing, e.g. in the **process** of selecting **products** and services, and in connecting with **selected** suppliers. The rise of these “**infomediaries**” is typical for Internet because of the abundant and open information supply. Infomedairies **may also** – if **neutral** – **verify** the identity of buyers and sellers, and **certify crucial** information transfer (Saanen et al., 1999). It seems that the **function** of cities as meeting and information places for routine and less complex matter **may** be taken over by **all** kind of virtual intermediaries. **However**, at the same **time** it seems that new types of physical meeting and information centres **will** arise in close interaction with **electronic ones**, maybe with a lower frequency than previously but with the important role to make **electronic** meetings and information handling run smoothly. Thus, face-to-face contact and telecommunication seem inextricably intertwined (Mitchell, 1999).

Emergence of E-firms

The rise of **e-firms** can be observed in **many** value chains. These **firms** not only save substantial **costs** of retail outlets, inventory and personnel, but they **may** cover the entire world as their market area. **However**, substantial entry barriers arise in situations **where** “**first movers**” have established market positions, trade **marks** and customer relations. Thus, entry barriers of followers consist of **considerable costs** of marketing in order to attract the attention of customers. It is not easy to assess the impact of these developments on the **function** of cities and transport and traffic; this is the more true because **many** new initiatives of **e-firms** are not **successful**. In **any** case, we **may expect** some blurring of the central **place structure** with more diffuse market relations and thinner good flows. In addition, what might happen is that established **firms** – by **co-operating** with **e-firms** and establishing **e-firms** by themselves – strengthen their position, particularly those **firms** located in certain large and medium-sized towns because they **enjoy** particular agglomeration **economies** available here.

Innovation

An important answer to the increased competition **from** e-activity is innovation. We **expect** that what is indicated above for the rise of **e-firms** **also holds** true for innovative activities of established **firms**. Given the previously **discussed** constraints in **tacit** and contextual

communication one **may draw** the conclusion that large cities and some smaller **ones remain** the seedbed of innovations. These cities are not only connected with the fastest telecommunication grids in the world, they **also** host a reservoir of specialised knowledge workers serving complex data-processing and application (Glaeser, 1998). This situation seems **also** true for the **function** of cities as headquarter **centres**. If we take Amsterdam as an example for headquarter activity in the **financial** services chain, there seems to be a consolidation in the past years (Table 4). The number of jobs has increased, but the share in the national total has remained the same. What is remarkable is a **slight** decrease of the share in **all** headquarters in the Netherlands. An in-depth analysis **however**, shows that this decrease **can** be partly attributed to a withdrawal of foreign banks due to **internal** reorganisation (van Geenhuizen and van der Knaap, 1998). The **latter** observation shows that urban functions are **also** subject to other influences than ICT and the **e-economy**, and these are **difficult** to disentangle.

Table 4 Indicators for spatial **dynamics** in **financial** services in The Netherlands

Local and regional level (a)	1991	1998	Change
Number of retail offices	3971	3140	- 20.9%
Number of offices including special customer services	93 (b)	247	+ 165.6%
Amsterdam			
Number of jobs (x1000)	44,6	51,5	+ 15.5%
Share of jobs in national total (%)	22,6	22,3	+/-
Share of headquarters (%)	61,5	55,0	- 6.5%

- (a) Data for retail **offices** derived from the three largest banks in NL, data for **higher level offices** derived from ABN-AMRO and ING.
 (b) 1988
 Bron: van Geenhuizen, 2000.

Flexibility of Work Locations

Already for some years, the use of **electronic** communication has enabled employees to **perform** working tasks at home that would otherwise be **performed** in the working **place** (telework). It seems that there is only a partial substitution, based **upon** a **couple** of social-psychological reasons, like the need for **social contacts** in the workplace and the need for a certain travel **time** (to “disconnect” **from** home and work) (Salomon, 2000). A relatively new development is the establishment of telecentres (or “**flex-offices**”) at the edge of agglomerations, **where** employees from different **firms** work by connecting themselves electronically with their headquarters. These developments seem to lead to a reduction in the

number of cotnrnuting trips and a reduction in **average** distance. **However, there** is hardly **any knowledge** of the secondary impacts, although these **may** be as important as **the primary ones** for **the** function of cities. It is **plausible** that a reduction in **the** nurnber **and** distances of commuting trips **causes** a relocation of living **places** at larger distances **from the** city **centre**, thus increasing suburbanisation over larger **areas**.

Table 5 Impacts on urban functions and transport

Value chain changes	Urban functions	Transport and traffic	Uncertainty (a) Direction Magnitude	
Pull by customers	Decrease of role as a node in distribution	More trips and higher frequency	+	+
	Decrease of retail function and other services at the lowest (local) level	Decrease of customer trips on level of living quarters and small centres		+
Customer management and services	Increase of retail and other services at higher (regional) level	Increase of customer trips at higher levels (sub-centres in cities and medium-sized towns)		+
Desintermediation (elimination of physical markets, auctions, etc)	Decrease of trade and transaction centre function at different levels	Decrease of trips for trade and transactions at different levels (see also 1)	+	++
Ze-intermediation (insertion of virtual intermediaries)	Some loss of function of meeting and information place but new forms	Some decrease of trips to city centre or sub-centre for meetings and information	++	++
Emergence of e-firms with global markets and of global e-webs	Blurring of the central place system (urban hierarchy)	More dispersed flow of customer trips, good supply, and work trips		++
		Adjustment of global logistic chains	++	++
Increased innovation	Remaining strong incubation function of large cities, and some medium-sized ones	No change	+	+
Flexibility of work locations	Partial loss of work fnnction by central city, and gain by edge	Less and on average shorter commuting trips Less focus on central city		+
	Maybe spread of living function	On average longer trips	+	++

a. • + small; + = considerable; ++ = large

6. Uncertainty

If one thing stands clear it is that the pattern of impacts of the e-economy on cities is highly differentiated, both with **regard** to urban **functions** and with **regard** to the spatial **scale** level. In addition, the images and expectations of changing urban **functions** and transport and **traffic** indicated in the previous sections are by no **means** certain, and this **holds** both for the direction of the impacts and their magnitude. Four changes are relatively clear in terms of direction. These are a decrease of retail activity at the lowest level, increase of customer services at **higher** levels, a **blurring** of the market **function** (central place), and a loss of workplaces in city **centres**. High uncertainty – both in terms of direction and magnitude – exists with **regard** to impacts of new (information) intermediaries and impacts of **e-firms** and e-webs of production. Traditional meeting place and relatively simple **information** supply **functions** may disappear **from** the cities. **However**, new physical meeting **places** – closely related with **electronic** networks and clubs – may arise but these are largely **unknown** to date. **Also** largely unknown are the impacts **from** the reorganisation of global logistic chains on cities as nodes.

Uncertainty stems **from** various sources, i.e. the complexity of urban reality, the **lack** of knowledge about new **ICTs** and about the direct and indirect impacts that unfold **after** different **times**. In addition, interest groups respond quickly to new opportunities partly in a fashionable way, but they **may also** easily **shift** attention. This **turbulence** increases complexity, particularly in terms of policy-making. Another point that **needs** to be kept in mind is that the available knowledge is fragmented and not achieved in a **co-ordinated** way. In this context we **can identify** the following knowledge gaps:

- The **pace** of the changes; to what extent are physical (infra)structures or ongoing developments working as impediments to change, or as catalysts or movers of change?
- The comprehensiveness of the changes; are the impacts **general**, or **specific** for particular value chains?
- The **causal** background of the changes; to what extent are particular adjustments in the **value** chain **caused** by **ICTs** and the e-economy or by other (autonomous) organisational changes with similar impacts?
- The **nature** of indirect **effects** on the city, and the different **time-scales** involved.

This situation of important unanswered questions has two implications for ICT policy and for urban policy at different levels. First, there is a need for increased research and experimentation efforts, and a better **co-ordination** of these efforts. Secondly, the manifold uncertainty **needs** to be dealt with in policy-making, and one important way for this is the design of flexible **policies** that **can** be adapted in **time**. An adaptation of **once chosen** policy **lines** is needed if actual developments turn **out** to be different **from** expected **ones** and new results **from** research and learning experiments become available.

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